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YELLOW-HEADED SPRUCE SAWFLY

BLACK DUCK DISTRICT

CHIPPEWA NATIONAL FOREST

by

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INTRODUCTION

Reported incidences of the yellow-headed spruce sawfly in two white spruce plantations on the Black Duck District, Chippewa National Forest were evaluated July 26-28, 1977 to determine the status of the host and insect.

This native insect attacks most species of spruce that grow in boreal forests (Nash, 1939). It feeds first on new foliage then, as an older larva, it will eat any foliage on the spruce tree. The yellow-headed spruce sawfly prefers young, open-grown stands of spruce on fine textured soils.

Adults are present in May and June about the time new spruce shoots are 1-inch long. They are most active on warm, sunny days when they oviposit, 1 egg/needle, on new foliage. The larvae are clustered, but do not form tight colonies. Feeding ends about July 1, and the prepupae form cocoons in the soil beneath the host tree. Pupation occurs in the spring of the year.

The two plantations evaluated were surveyed in 1976 along with 14 other spruce plantations on the Chippewa National Forest. The intensity of defoliation on sample trees was recorded at that time for 1976 and 1975. That evaluation showed that one of the plantations now under consideration was moderately to heavily defoliated for two successive years. The other plantation had only light defoliation in 1976 and none in 1975. No chemical or biological means were used to suppress the infestations.

The yellow-headed spruce sawfly is a minor pest most of the time, but occurs frequently in Minnesota where it can be a major pest in individual plantations. Because of the infrequency of general outbreaks, no survey system has been developed for the insect in any of its stages. The

presence of defoliation over most of the stand and cocoons in the soil were usually indications that the sawfly would be active the next year. This same technique was used in 1977. Defoliation estimates were made on 50-tree plots randomly selected in rows of trees. There were 14 plots (700 trees) selected in plantation 16 and 12 plots (600 trees) selected in plantation 18. At every 50th tree, a 1 ft^2 litter and soil sample was taken at the base of the tree to look for overwintering prepupae cases and evidence of small mammalian predators.

TECHNICAL INFORMATION

Causal Agent - Yellow-headed spruce sawfly (Pikonema alaskensis (Rowher)).

Host Tree - White spruce (Picea glauca (Moench) Voss). Other spruces are attacked, but only white spruce was present in these plantations. The trees are 3 to 15 ft. tall in plantation 16, and 4 to 20 ft. tall in plantation 18. There are about 850 trees/acre in each plantation.

Type of Damage - Defoliation. New foliage is eaten by young larvae; and large larvae eat older as well as current foliage. In Maine, of 100 Norway spruce defoliated, 40 died (Nash, 1939). Shoot length is reduced the year after two defoliations by 70% (Kulman, 1971). Defoliation begins at the top of small trees and eventually includes the whole tree when sawfly population are high and persistent. Spruce that is overtopped by hardwoods is seldom defoliated by yellow-headed spruce sawfly. In this evaluation, the following defoliation classes were used:

Trace, 1-5 shoots destroyed.
Light, up to 25 percent defoliation.
Moderate, 26 to 59 percent defoliation.
Heavy, 60 to 100 percent defoliation.
Dead.
Missing trees and trees killed by other factors were not included.

In plantation 16, defoliation levels were:

Trace	58 trees	(8 percent)
Light	33 trees	(4 percent)
Moderate	98 trees	(13 percent)
Heavy	481 trees	(71 percent)
Dead	30 trees	(4 percent)
	700 trees	100 percent

In plantation 18, defoliation levels were:

None	533 trees	(89 percent)
Trace	49 trees	(8 percent)
Light	12 trees	(2 percent)
Moderate	6 trees	(1 percent)
	600 trees	100 percent

Defoliation was spotty in plantation 18. Seven spots of heavy defoliation were found near the sample rows. Each spot had one or two trees that had heavy defoliation and four to six trees that were moderately defoliated.

Biological Data - The buds on most defoliated trees seem to be healthy, although they appeared to be smaller on trees in plantation 15. No measurements were taken of the buds or of shoot length.

Several spruce trees that were attacked by gall aphids were free of sawfly damage.

No new sawfly cocoons were found in the soil samples. Only 21 old cocoons could be found in plantation 16; none in plantation 18. Duff and soil sampling is notoriously inaccurate, but is the only method useable at the time of the evaluation.

Nearly 80 percent of the duff samples showed that small mammals- voles, mice, or shrews- had been active because tunnels were present. There were no new cocoon remains to indicate that the mammals had fed upon the insects. Houseweart (1976) reported up to 66 percent of overwintering cocoons were destroyed by small mammals and insect predators.

Most of the lightly defoliated trees in plantation 16 are in one area where quaking aspen (Populus tremuloides Mich.) sprouts overtop the white spruce.

No egg parasitism was found in studies of the sawfly in Minnesota (Houseweart, 1976). Nash (1939) reported one percent of sawfly eggs parasitised by Trichogramma minutum Riley and from 2 to 80 percent of the larvae parasitised by the tachinid fly Bessa selecta (Mg.). Since eggs and free-living larvae were not present during the survey, the impact of these parasites could not be evaluated.

Environmental Factors - Flooding would kill the over-wintering pre-pupae or spring pupae, but likely flood areas amount to only 20 acres in plantation 16. The soil type is evidently suitable for sawfly survival. The trees are small and therefore subject to continued defoliation by sawflies. Most of the trees are situated among grass and other low vegetation so there is no protection of spruce from an overstory. Shading usually discourages sawfly population increases.

Location and Extent of Outbreak - Plantation 18, about 250 acres, is located in the southern portion of section 20, T149N, R29W, along road 3416, 8 miles east of Black Duck. Plantation 16, about 325 acres, is located in section 2, T147N, R31W, along road 2177, 10 miles south of Black Duck (Figure 1).

DISCUSSION

Plantation 18 is in no immediate danger of tree mortality or significant tree growth loss as a result of yellow-headed spruce sawfly feeding.

Plantation 16 has had one year of light to moderate defoliation, and two years of moderate to heavy defoliation. Tree mortality, however, is not common after one or two years of defoliation by yellow-headed spruce sawfly. White spruce height growth and branch expansion can be reduced by 70 percent after three consecutive years of defoliation (Kulman, 1971). Normal growth rates return about three years after sawfly attacks end.

Secondary events will cause extensive tree mortality. One of these, drought, does not seem to be a problem in 1977 in plantation 16. The other problem, shoe-string root rot (Armillaria mellea Vahl.) could kill many seedlings weakened by sawfly damage. The fungus is probably present in the soil because the site was recently forested.

Because the greatest impact on the sawfly population occurs during the winter and early spring (by predators and weather), accurate predictions of defoliation in 1978 cannot be made at this time. Count of eggs and first instar larval damage in May is the only reliable system for predicting defoliation. Such a presuppression survey would be too late in the season for planning, and obtaining approvals for, suppression activities. Based on the history of the infestation, tree condition, and plantation development, preparation for chemical suppression of yellow-headed spruce sawfly on plantation No. 16 in 1978 should begin immediately.

RECOMMENDATIONS

White spruce trees in plantation No. 18 are in excellent condition. Defoliation by yellow-headed spruce sawfly is spotty, though heavy on some individual trees. Suppression of the insect in this case is not biologically necessary in 1978. The situation should be evaluated again in 1979.

In plantation No. 16, the trees have been defoliated by increasing amounts for the last three years. Another heavy defoliation, in 1978, could mean extensive tree mortality. How much mortality would be pure conjecture. Records do not indicate how many trees died after several successive defoliations of white spruce. This evaluation shows that four percent of the trees have already died because of defoliation. There are three alternative methods for handling the outbreak:

1. Do nothing. Accept the growth loss of up to 70 percent. Surviving trees will regain growth in three or four years, after sawfly populations return to endemic levels. An unknown number of trees may die if defoliation occurs in 1978. The duration of the outbreak cannot be predicted; therefore, defoliation may occur in 1979 and 1980 also.

2. Use methoxychlor (B. G. Pratt EC2 Methoxychlor insect spray) Three quarts of 25% concentrate in 100 gallons of water, in a hydraulic sprayer. Each tree must be sprayed without soaking; therefore, 100 gallons of formulation should treat an acre. This ground application is made when the larvae are in the second instar which might be the last week of May.

   The same chemical can be applied with a mist blower, but the formula is more concentrated (12 quarts of concentrate and water to make 50 gallons of mix). One hundred gallons of mixed formulation will be needed on an acre of spruce. Both methods and formulations are registered.

3. Treat aerially with 10 fluid ounces ULV Cythion (95 percent technical material) when the larvae are in the second instar. This treatment is <u>not</u> registered for control of yellow-headed spruce sawfly on white spruce, It is, however, registered by the Environmental Protection Agency for control of European pine sawfly (<u>Neodiprion sertifer</u> (Geoff.)) which occurs in Michigan and Ontario. In 1975, the Minnesota Department of Natural Resources used Malathion (the same chemical as Cythion) for control of yellow-headed spruce sawfly with "good" results. The treatment is <u>not</u> registered in Minnesota.

Use of the treatment against the yellow-headed spruce sawfly on the Chippewa National Forest would need to be approved by the Environmental Protection Agency under provisions of Pesticide Enforcement Policy Statement No. 5 (Federal Register, Vol. 41, No. 184 - September 21, 1976). Although the yellow-headed spruce sawfly is common in the Lake States, there is an infrequent need to control it. When compared to populations of other forests or other agricultural pests which need frequent control, yellow-headed spruce sawfly is an improbable target for frequent chemical suppression, and is therefore included in PEPS No. 5.

Should the Supervisor, Chippewa National Forest, decide that Cythion will be used to suppress yellow-headed spruce sawfly in plantation 16, an Environmental Analysis Report (EAR or EIS) should be filed with the Environmental Protection Agency through the Regional Forester and the Area Director.

If methoxychlor treatment is selected, an EAR or EIS (environmental acceptability section), this biological evaluation, a (biological effectiveness section) and an economic efficiency section should be submitted with project proposals and operation plan to the Regional Forester and the Area Director in accordance with FSM 5281.4.

Forest Insect and Disease Management, St. Paul Field Office, is available for technical assistance in making presuppression surveys and postsuppression evaluations of efficacy; planning the projects; and in assessing the chemical application.

Literature Cited

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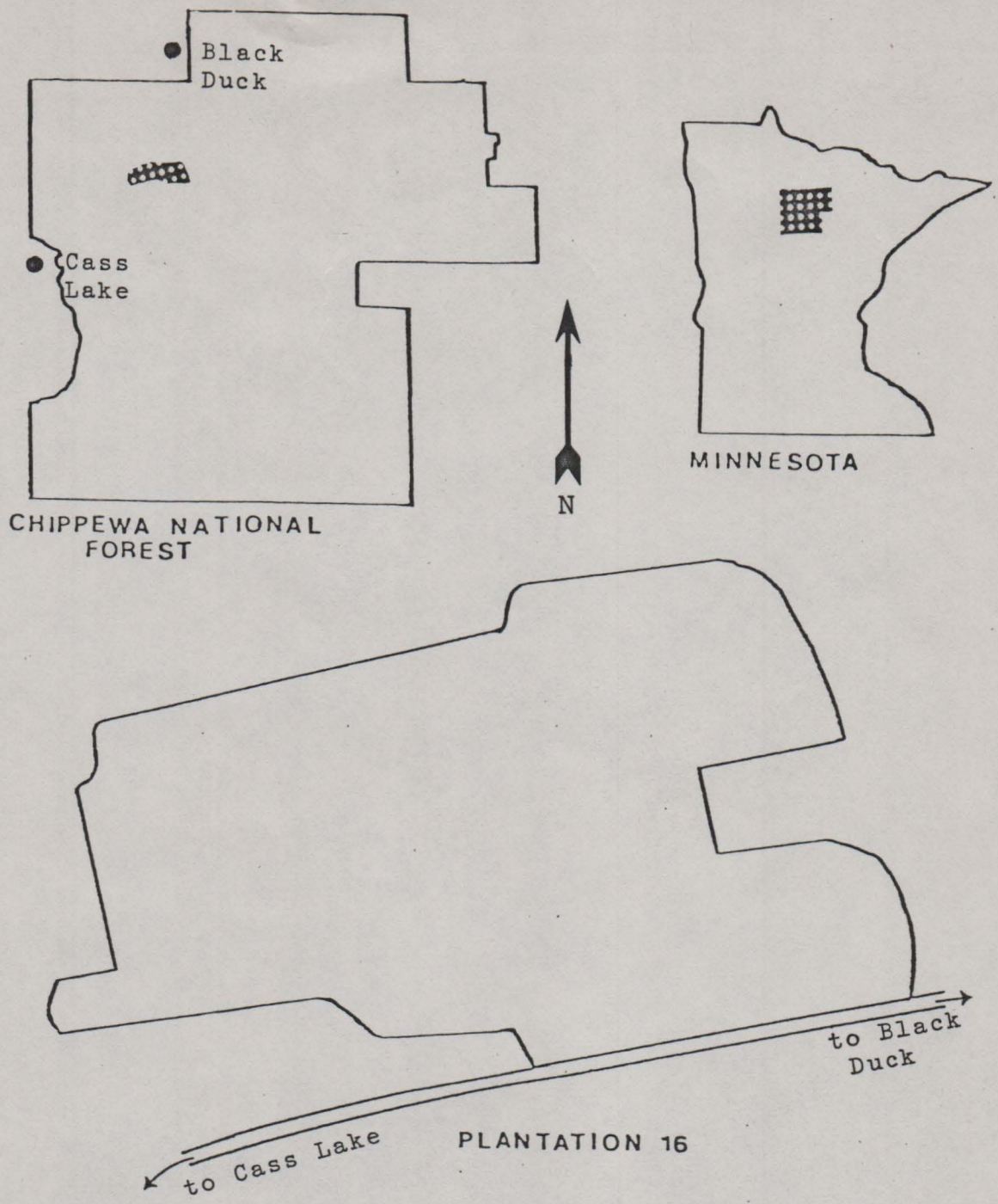

Figure 1. -- Map of plantation 16, Chippewa National Forest. Yellow-headed spruce sawfly evaluation, 1977.